

Determinants of low birth weight and its relationship with stunted toddler status in Magelang Regency, Indonesia

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Abstract. Stunting contributes to a decrease in the quality of life. One of the potential factors which causes stunting is low birth weight (LBW). The objectives of this study are (1) to obtain representations of the characteristics of mothers and stunted toddlers; (2) to analyze the influence of maternal age at birth, gestational age, maternal hygiene and health behavior, and maternal nutrition knowledge related to LBW; and (3) to identify the relationship between LBW and stunted toddlers in Magelang Regency. This study used a mix-method approach that combined primary data and in-depth interviews. The binary logistic regression results found that maternal age at birth, gestational age, maternal hygiene and health behavior, and maternal nutritional knowledge had a significant effect to LBW on stunted toddlers.

1 Introduction

The condition of the mother before pregnancy and during early pregnancy is a phase that determines the level of development of future generations. The mother's health and the nutrition that she obtains will affect the condition of the baby born. A mother whose nutritional intake is insufficient and who is experiencing chronic energy deficiency has the potential to give birth to a baby with low birth weight. Such infants are at risk of experiencing malnutrition, the impact of which will continue in the next phase of life [1].

Growth in toddlerhood is one measure of the degree of health in adult life. Stunting is one of the growth disorders in childhood and is a chronic nutritional problem that Indonesia continues to face. The cause of stunting is an imbalance between the needs and actual nutritional intake of the body in the long run. Toddlers who are stunted may suffer irreversible severe physical and cognitive impairment [2]. Stunting has also become a global concern, with the inclusion of a stunting prevalence indicator in the second of the Sustainable Development Goals (SDGs) in Target 2.2, namely the elimination of all malnutrition problems by 2030 and of toddler stunting by 2025.

In 2018, all regions in Indonesia had a high (20 - <30 percent) or very high (≥ 30 percent) number of cases of stunting, apart from for DKI Jakarta, whose level was 17.6 percent (moderate). The results of the Nutrition Status Monitoring (NSM) of 2017 showed that 28.5 percent of toddlers faced stunting problems in Central Java. By 2018, the region was included in the very high category for the prevalence of stunted toddlers (31.2 percent), a figure which exceeded the national average of 30.8 percent. From the 2017 NSM data, it can also be seen that the stunting rate of Magelang Regency reached

37.6 percent, second worst among the regencies/cities in Central Java [3]. However, based on the results of National Basic Health Research (Riskesdas) 2018, the stunting rate in Magelang Regency had decreased to 29.69 percent [4].

Stunting in toddlers can be caused by various factors, one of which is LBW, which is the cause of around 20 percent of incidents [1]. According to the World Health Organization, low birth weight refers to babies under 2,500 grams [5]. Prendergast and Humphrey state that birth weight and birth length are associated with subsequent growth in childhood [6]. If this is added to other factors such as insufficient nutritional intake and if the health of toddlers is not well maintained, meaning they experience illness or infection, the risk of experiencing stunting is higher [7].

The causes of the incidence of LBW are multidimensional, making it difficult to take precautions. However, in general it is related to characteristics of the mother's pregnancy, such as prematurity; pregnancy/birth at risk (maternal age < 20 or > 35 years); socioeconomic conditions that lead to lack of nutrition during pregnancy and no pregnancy checks; and poor lifestyle during pregnancy such as smoking, drinking alcohol and taking drugs [8]. Donal et al. state that the incidence of LBW is related to risk factors to maternal health identified by traditional examinations (traditional birth attendants) or antenatal examinations, such as drinking alcohol or smoking [9].

Stunting and LBW can also have an impact on the economy of the country and of households. Stunting can cause potential economic losses due to decreased productivity of around 3-14 trillion rupiah, equivalent to 0.04-0.16 percent of Indonesia's Gross Domestic Product [10]. The results of the study by Sicuri et al. of low-income countries show that reducing the prevalence

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of LBW will save both healthcare and household costs [11]. Therefore, this study intends to determine the characteristics of mothers and stunted toddlers; to assess the determinants of LBW in stunted toddlers in terms of maternal characteristics; and to identify the relationship between the incidence of LBW and the status of stunted toddlers in Magelang Regency.

2 Methodology

The research used a combination of quantitative and qualitative methods, with the quantitative being the main approach. The results from this method were analyzed qualitatively, which allowed verification of the findings and ensuring that the resulting analysis was more comprehensive and in-depth.

The quantitative method used primary data from field surveys conducted in 2019, together with a structured interview method for the families of stunted toddlers, and secondary data from the Magelang District Health Office. On the other hand, the qualitative data collection technique used involved in-depth interviews with three informants, namely a village midwife, a coordinating midwife, and a public health center nutrition officer. The sample comprised 242 families of stunted toddlers. Independent variables of maternal characteristics were employed, which were indicated by maternal age at birth, gestational age, maternal hygiene and health behavior, and mother's nutrition knowledge. Maternal hygiene and health behavior were reflected by the habit of washing hands with soap and maternal nutritional knowledge is approached with knowledge about 4 healthy 5 perfect nutrition. The first objective of the study was analyzed descriptively with tables, the second with binary logistic regression, and the third with a contingency coefficient. The results of the data processing were then strengthened by the results of the in-depth interviews.

3 Results and discussion

3.1 Characteristics of mothers and stunted toddlers

Observing the characteristics of mothers of stunted toddlers, the majority of babies were born without a history of LBW; sufficient gestational age; mothers gave birth at a non-risk age (20-35 years); they

demonstrated hygienic and healthy behavior by washing their hands with soap; and had knowledge about 4 healthy 5 perfect nutrition. As shown in Table 1, the number of mothers who gave birth to stunted toddlers with a history of LBW at a risky age was 19.23 percent, while mothers who gave birth with no risk numbered 7.37 percent. 36 percent of stunted toddlers who experienced LBW were born prematurely, while 6.91 percent were born at full term. 9.05 percent of mothers of stunted toddlers who displayed hygienic and healthy behavior in their daily life had stunted children with LBW, while the figure for mothers of stunted toddlers with LBW who did not show hygienic and healthy behavior was 19.05 percent. 8.88 percent of mothers who had knowledge of nutrition gave birth to LBW babies, while 17.86 percent of those who had no knowledge of nutrition did so.

As can be seen in Table 2, 33.49 percent of stunted toddlers who did not experience LBW had a very short body posture, while 62.50 percent of those who did experience LBW had such a posture. This indirectly shows that a higher proportion of toddlers with a history of LBW develop with very short stature compared to those who did not experience LBW.

3.2 Influence of maternal age at birth, gestational age, maternal hygiene and health behavior, and maternal nutritional knowledge on stunted toddlers' LBW

The stages of the binary logistic regression consisted of a model significance test, model accuracy test and partial test. The significance of the model using Omnibus Test showed a p-value of $(0.000) < \alpha (0.05)$, meaning that at least one of the four independent variables significantly influenced the incidence of LBW. The model accuracy test using the Hosmer-Lemeshow test showed a p-value of $(0.344) > \alpha (0.05)$, indicating that the model was fit and it was possible to progress to the partial test (Wald test). Table 3 shows that maternal age at birth, gestational age, and maternal hygiene and health behavior significantly influenced the incidence of LBW, at $\alpha = 0.05$, while maternal nutritional knowledge was significant at $\alpha = 0.10$. Broadly speaking, all the independent variables significantly affected the incidence of LBW as their p-values were $< \alpha$.

Table 1. Number of low birth weight incidents of stunted toddlers according to mothers' characteristics in Magelang Regency, 2019.

Mother's Characteristics		Incidence of LBW		Total
		Yes	No	
Maternal age at birth	At risk (< 20 or > 35 years)	10 (19.23%)	42 (80.77%)	52 (100%)
	No risk (20-35 years)	14 (7.37%)	176 (92.63%)	190 (100%)
Gestational age	Premature (<9 months)	9 (36.00%)	16 (64.00%)	25 (100%)
	Normal period (\geq 9 months)	15 (6.91%)	202 (93.09%)	217 (100%)
Maternal hygiene and health behavior	No	4 (19.05%)	17 (80.95%)	21 (100%)
	Yes	20 (9.05%)	201 (90.95%)	221 (100%)
Maternal nutritional knowledge	No	5 (17.86%)	23 (82.14%)	28 (100%)
	Yes	19 (8.88%)	195 (91.12%)	214 (100%)

Table 2. Tabulation of incidence of LBW and status of stunted toddler in Magelang Regency, 2019.

LBW	Stunting Status	
	Stunted	Severely Stunted
(1)	(2)	(3)
No	145 (66.51%)	73 (33.49%)
Yes	9 (37.50%)	15 (62.50%)
Total	154 (63.64%)	88 (36.36%)

Table 3. Estimation of parameters and odds ratio for the LBW incidence of stunted toddlers.

Independent Variable	Dependent Variable: Incidence of LBW		
	B	Sig.	Exp (B)
(1)	(2)	(3)	(4)
Constant	-3.377	0.000	0.034
Maternal Age at Birth (X_1)			
No risk	-	-	-
At risk	1.087	0.028	2.967
Gestational Age (X_2)			
Normal period (≥ 9 months)	-	-	-
Premature (< 9 months)	2.461	0.000	11.722
Maternal Hygiene and Health Behavior (X_3)			
Yes	-	-	-
No	1.309	0.046	3.704
Maternal Nutritional Knowledge (X_4)			
Yes	-	-	-
No	1.142	0.062	3.134

The tendency of mothers to give birth to LBW babies at a risky age was 2.967 times higher than that of mothers who gave birth at a non-risky age, assuming that the other independent variables remained the same. Mothers who are pregnant in their teens are still at their growth stage [12], so their nutritional intake is divided between the mother and the fetus [13]. This has an impact on the development of fetal weight in the womb. The incidence of LBW babies is mostly in young couples due to the incomplete development of the female reproductive organs and insufficient maternal nutrition during pregnancy [14]. Pregnancy that occurs when the mother is less than 20 years old is a direct factor that increases the risk of LBW [15] and an indirect factor that affects stunting status in children [16]. Women who give birth at > 35 years old are more at risk [17-18] because of decreased organ functions and general health, so they are prone to bleeding, prolonged labor and LBW babies [19]. In addition, pregnant women over 35 years of age are also associated with decreased nutrient absorption, which has an impact on the insufficient intake for both the mother and the fetus [20].

Maternal age affects the physical and mental readiness of the mother in preparing for pregnancy and childbirth. The results of the interviews with the village midwife at one of the public health centers in Magelang Regency showed that maternal age at birth was a determining factor in low birth weight. Pregnancy at non-ideal ages can cause anemia and chronic energy deficiency.

“In Magelang Regency there are still mothers under 20 and over 35 years old who give birth. Lack of parental supervision of children, free use of the internet, and cultural factors and beliefs,

such as the prohibition against refusing marriage proposal and not participating in family planning due to the assumption that ‘many children have a lot of fortune’ are the cause.”

The tendency of mothers giving birth to LBW babies prematurely (< 9 months) is 11.722 times higher than women giving birth at full term (≥ 9 months). Preterm birth is the dominant cause of the incidence of LBW [21-23]. According to Manuaba, when gestational age is less than 9 months, the formation of the fat storage system is disrupted, which causes risk to LBW babies [12]. Through in-depth interviews, the village midwife stated that premature gestation was one of the risk factors for LBW.

“Gestational age especially premature is one of the factors affecting LBW cases and stunting in this region.”

Mothers who were not accustomed to hygienic and healthy behavior tended to give birth to LBW babies 3.704 times more than mothers who displayed such behavior, assuming other independent variables remaining the same. One of the risk factors in increasing the chance of LBW is mothers with a history of disease during pregnancy [24]. Washing hands with soap is one of ten types of household hygiene and health behavior that acts as self-protection and family protection to prevent germs and diseases from entering the body [25]. Mothers who do not demonstrate such behavior in their daily life tend to be more susceptible to infection and disease affecting the mother and baby, thus increasing the risk of LBW.

The tendency of mothers who do not know about 4 healthy 5 perfect nutrition to give birth to LBW babies is 3.134 times higher than for mothers who do know this, assuming other independent variables to be the same.

Mothers who know about such nutrition tend to be more careful in maintaining nutritional intake during pregnancy, which will affect their nutritional status and increase the weight of the fetus in the womb until birth. Nutritional intake during pregnancy is a menu designed to meet the needs for micronutrients and macronutrients that function in the growth of the mother and fetus. Iron, calcium, zinc and vitamins are examples of the ingredients in the 4 healthy 5 perfect intake needed by the mother to reduce the risk of LBW [26–29].

From the results of the interviews with the coordinator of midwife and nutrition officer at one of the public health centers in Magelang Regency, information was obtained showing that maternal nutrition knowledge will determine their nutritional intake during pregnancy, which is an important factor in determining LBW. Mothers' lack of knowledge of nutrition will affect the condition of their pregnancy because of insufficient nutritional intake, leading to anemia and chronic energy deficiency, which increase the risk of LBW. Pregnant women who do not know about 4 healthy 5 perfect nutrition tend to pay less attention to nutritional intake, for example protein, meaning they lack protein, as does consequently the fetus.

"Maternal factors such as anemia and chronic energy deficiency, gestational age especially premature, twin baby, too low or too high maternal age, nutritional intake that is influenced by maternal knowledge, and maternal mental readiness are factors that influence cases of LBW and stunting in this region. A mother can be anemic because of low understanding of nutrition that affect to her nutritional intake. Premature birth due to twin baby, nutritional factors, and economic factors -not many cases- are more likely to be maternal knowledge."

3.3 Relationship between LBW and the status of stunted toddlers

The relationship between the incidence of LBW and stunting status was statistically tested by the contingency coefficient. The results of the association test showed that the association between LBW and stunting status was statistically significant because of the p -value of $(0.005) < \alpha (0.05)$.

LBW disrupts the growth and development process over the long term and leads to a high risk of experiencing growth failure or stunting as a consequence. LBW indicates that the fetus has experienced slow growth in the womb, that continues until the baby is born. The growth of LBW babies is slower than ones with normal birthweight, due to the impaired digestive functions experienced by them, which then causes obstacles to the absorption of nutrients into the body [30]. Slow growth in early life makes it difficult for LBW babies to achieve the same optimal growth as those with normal birthweight if this is not balanced with adequate nutritional intake (such as fat and protein) after birth [7, 19]. LBW also causes toddlers to be more susceptible to infectious diseases,

such as diarrhea and ARI, so that their growth is not optimal.

Based on the results of the interviews with the village midwife, it was established that LBW is one of the risk factors for stunting in Magelang Regency.

"The factors that cause stunting are LBW, nutritional intake when pregnant and when the child is born, economic factors, parenting styles, culture, and provision of complementary feeding too early."

Magelang Regency Health Office's Chief of Family Health and Nutrition Section also added that LBW will affect the length of the baby (usually born short) and inhibit their growth, so that the risk of stunting is higher.

"LBW has an effect on cases of stunted toddlers, toddlers born with low body weight are usually low in height too. Therefore, it needs prevention before birth."

This result is congruent with Putri and Qomariyah's research findings. They found that one of the factors related to stunting in Purwomartani was birth weight. Purwomartani is a village with the highest incidence of stunting in Kalasan, Sleman, Yogyakarta in the surrounding Magelang areas [31].

4 Conclusion

In general, the representation of the characteristics of the mothers of stunted toddlers in Magelang Regency was good, with more mothers giving birth to stunted toddlers at a non-risky ages, at full-term gestation, with hygienic and healthy behavior, and with knowledge of nutrition, especially 4 healthy 5 perfect. The results show that maternal age at birth, gestational age, maternal hygiene and health behavior, and maternal nutritional knowledge significantly influenced the incidence of LBW. The association test showed a significant relationship between LBW and stunting status, while the results of the in-depth interviews also confirmed the findings obtained from the quantitative method.

The authors would like to thank the Magelang Regency Government, the Magelang District Health Office, the informants and the related stakeholders who contributed to providing data and information, and supporting the smooth running of this research.

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